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Integrated planning and management of land resources

Report of the Secretary-General

Addendum

Conservation of biological diversity*

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I. Introduction

1. The present addendum supplements the report of the Secretary-General on integrated planning and management of land resources, from the perspective of the conservation and sustainable use of biological diversity. Emphasis is placed on landscape diversity,[1] which expresses the numerous relations within a landscape, including cultural and geographical features as well as natural elements, and the functions of biodiversity, both above and below ground, in providing ecosystem goods and services, including food and biomass production. The analysis is not exhaustive but illustrates some areas where progress has been made in understanding and addressing biodiversity issues as an integral part of land resources planning and management, taking into account the strategic objectives of food security, socio-economic development and environmental conservation at the global, national and local levels.

2. Human activities are impacting on biological diversity in many ways, through the intensification and/or expansion of productive land use, the expansion of human settlements, industrialization and infrastructure, and the associated effects of pollution and wastes, on the one hand, and the creation of protected areas on the other. In addition, biodiversity is being impacted upon by climate change and by natural events, such as floods and cyclones. Human activities can be managed to a greater or lesser extent, depending on the environmental, socio-economic and political context and the capacities of all the concerned stakeholders. The impacts of natural phenomena at the local level can be moderated through appropriate risk-alleviating strategies and actions that influence land use and natural resources management. Moreover, changes in land use and vegetation cover influence climatic variability since these affect the flows and balances between the land and the atmosphere in regard to greenhouse gases, carbon, nitrogen and water cycles, as well as energy. Thus, trends in biodiversity loss can be significantly modified through appropriate land management options, which may also contribute to sustained productivity, carbon sequestration, combating degradation and other development goals.

3. Since the United Nations Conference on Environment and Development (UNCED), held at Rio de Janeiro in June 1992, and with progress in the implementation of the Convention on Biological Diversity, there has been increased awareness and attention to biological diversity at the international and national levels, which has helped to catalyse research, monitoring and assessment activities and the development of strategies and actions at the country level in specific ecological zones or land types (drylands, coastal zones, inland water ecosystems etc.) and specific land uses (agriculture, forestry, rangelands and pastures, protected areas).

4. The increased understanding of the synergies between biodiversity conservation, sustainable use, carbon sequestration and combating degradation and drought should further promote the most appropriate and sustainable land management options. The aim should be to achieve positive impacts on these different dimensions, and not only on biodiversity so as to also contribute to the sustainable production of goods and services to meet increasing human demands. Such a transition to more environmentally sound methods of production, managing watersheds and accommodating urban growth has already begun in forward-looking communities and bodies in all regions. Progress has been made through approaches that allow more effective participation of concerned stakeholders, improved cross-sectoral cooperation and collaboration between government bodies, civil society groups and intergovernmental organizations. The real challenge is how to speed up this transition to more sustainable land use and environmental management in a range of contexts.

II. Developments and trends

Agriculture and forestry systems

5. The most widely cited impacts of land use change on biodiversity loss are those of agriculture and forestry activities, including impacts through land cover change (loss of natural forests, grasslands, mangrove swamps, wetlands and the species they contain), as well as three main impacts at the genetic resources level: reduced species and varieties of domesticated plants and animals as a result of breeding and development strategies; loss of wild species, including micro-organisms, that support food and agriculture; and wild species that depend on the land-use system and the landscape.

6. Despite increased recognition, the expansion of agriculture and the necessary intensification of activities to meet the demands of increasing numbers of humans, involving land clearance and encroachment on forest lands, wetlands, natural rangelands and grasslands, and increasing specialization in cropping and logging operations, livestock and fish production, remain major concerns in all regions. Attention has recently been paid to the damage to the life-support system caused by intensive technologies and management practices, in addition to the impacts on habitat and species loss of unsustainable practices that are prevalent in extensive systems and smallholder systems as a result of poverty and overexploitation of resources. The agricultural biodiversity assessment that has been prepared jointly by the Food and Agriculture Organization of the United Nations (FAO) and the Convention on Biological Diversity for consideration by the fifth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice of the Convention, to be held in January 2000, elaborates in greater depth the linkages between biodiversity and abiotic resources through its focus on landscape and ecosystem levels and on life-support functions in addition to the genetic resources level and human dimensions (see UNEP/CBD/SBSTTA/5/10 and UNEP/CBD/SBSTTA/5/INF/10).

7. There is increasing evidence that many of today's specialized agricultural and forestry systems may be unsustainable in that they cannot maintain current levels of production indefinitely, and there is a risk of the loss of essential ecosystem services, resilience and stability. Conversely, agriculture has been shown to also provide biodiversity-rich landscapes and resilient ecosystems that would otherwise revert to lower levels of biodiversity, such as farming in dryland areas, managed meadows and home gardens. Forest biological diversity is best conserved through *in situ* programmes and sustainably managed forests. Moreover, agriculture, forestry and livestock breeding activities have led to the development of large numbers of landraces and improved varieties, many of which are conserved *in situ* or *ex situ*. There is a renewed focus on the opportunities for sustainably developing and/or restoring integrated production systems and management practices that sustain production through diversification and maintenance and enhancement of life support systems.

8. The severe loss of forest biodiversity and forest lands and ongoing international actions to promote their conservation and sustainable use, through the Intergovernmental Forum on Forests (IFF), the Convention on Biological Diversity, FAO and others, are outlined in a separate addendum (E/CN.17/2000/6/Add.1). Several national, regional and international initiatives are under way to develop a global perspective on forest biological diversity. However, the crucial step in maintaining biological diversity in forests is the translation of this knowledge into improved forest management and conservation practices throughout the world. Major causes of forest cover change include conversion of forests to agricultural land and large infrastructure development in developing countries, and forest growth on abandoned agricultural land in developed countries. Forest fires, largely caused for land clearing purposes, have also resulted in serious forest degradation and losses in recent years.

Ecosystems facing degradation, desertification and drought

9. Land degradation has had major impacts on biodiversity through reducing land quality and its capacity to support animal, plant and microbial life and through impacts on natural ecosystems, especially fragile areas, such as wetlands, "montane" systems and small islands. Certain ecosystems require particularly careful management to prevent degradation, such as extensive grazing systems in dryland areas and fragile mountain ecosystems. Desertification is recognized as one of the main causes of biodiversity loss in the arid and semi-arid regions of the world. Hunting is also a major factor in such areas. In Africa alone, desertification is estimated to severely affect up to 40 per cent of the land area and the lives and livelihoods of millions of people. This issue is elaborated in a separate addendum (E/CN.17/2000/6/Add.2). As highlighted by the Twelfth Global Biodiversity Forum, convened in conjunction with the second meeting of the Conference of the Parties to the United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, particularly in Africa, in December 1998, the linkage between biodiversity, desertification, water resources and climate change is a reality for resource users in drylands. Prerequisites for addressing these interlinked issues are appropriate management

practices and technologies, in particular in regard to the limited water resources upon which biological resources depend.

Mountain ecosystems and protected areas

10. As indicated in a separate addendum (E/CN.17/2000/6/Add.3), mountain areas are very important but fragile reservoirs of biological diversity. The importance of forests and trees in mountain ecosystems has long been recognized in protecting upper catchments from erosion and degradation, replenishing groundwater and downstream water supplies, and moderating the water regimes of rivers and streams and the risks of siltation and flooding. There is increased public awareness today of the damaging effects of deforestation in mountainous areas in view of severe flooding in many parts of the world. Protected area management activities in mountainous regions have been strengthened in many countries, and it is now recognized that conservation efforts through parks, reserves and other protected areas also require attention to rural and economic development. The above-mentioned addendum provides further information on sustainable mountain development. Specific attention is drawn to montane forests, an increasingly threatened mountain ecosystem in the light of the critical role they play.

Inland water and coastal ecosystems

11. Recognizing their importance, the Convention on Biological Diversity has developed a specific programme of work on the conservation and sustainable use of biodiversity of inland water ecosystems, and coastal zones are addressed through the follow-up to the Jakarta Mandate, which promotes, *inter alia*, integrated coastal area management approaches. The importance of wetlands as key elements of inland waterways and coastal systems is reflected by the commitment by 117 Parties to the Convention on Wetlands of International Importance, Especially as Waterfowl Habitat (Ramsar Convention). The Convention promotes the integrated approach to managing wetlands systems and water resources, including their protection and wise use, their rehabilitation and the restoration of surrounding degraded areas. In order to facilitate implementation and foster cooperation, the Convention on Biological Diversity and the Ramsar Convention have developed a joint work plan. Wetlands in arid and semi-arid areas are addressed through cooperation with the Convention to Combat Desertification with a view to mitigating the impacts of drought and desertification. Resolutions adopted at the seventh meeting of the Conference of the Contracting Parties to the Ramsar Convention addressed restoration as an element of national planning for wetland conservation and wise use (resolution VII.17) and guidelines for integrating wetlands conservation and wise use into river basin management (resolution VII.18).

Rural and urban settlements and infrastructure

12. The expansion of urban and rural settlements and industrial activities as well as infrastructure development have led to substantial species and habitat loss. The pressures of urbanization are strongly felt in coastal and mountainous areas, which are important for tourism and recreation and also provide essential ecosystem services. Pressures from the resource use, pollution and waste generation in urban areas are usually much higher than in rural areas and may have far-reaching impacts. Nonetheless, gardening, urban and peri-urban agriculture and parks and reserves have maintained important levels of biodiversity in many cities. In fact, these are often vital in providing food security and shelter and in maintaining traditional species of fruits, vegetables, roots, tubers and ornamental plants. It may also provide important ecological functions, such as water cycling, climate regulation, watershed protection and wildlife habitats, as well as income-earning opportunities, recreation, aesthetic and cultural values. Despite reference to the urban/biodiversity interface in the Habitat Agenda (1996) and activities by the United Nations Centre for Human Settlements (Habitat) through its sustainable cities programme and support to environmental planning and management in urban areas with the United Nations Environment Programme (UNEP), urban biodiversity remains little known and recognized in terms of its values. Otherwise, efforts have focused on parks, gardens and zoos; combating pollution by hazardous chemicals, such as persistent organic pollutants; and reducing gas emissions that contribute to ozone depletion and acid rain.

III. Progress in addressing biodiversity as an integral component of land resources management

Improving understanding of biodiversity and land use interactions

13. Many international bodies (the Convention on Biological Diversity, the Commission on Sustainable Development, FAO, the Organisation for Economic Cooperation and Development (OECD), UNEP, the World Resources Institute (WRI) and others) are working to develop indicators for sustainable development and for biological diversity to assist in monitoring and assessing status and trends, the development or recovery of an ecosystem, and progress in promoting conservation and sustainable use, as well as for policy-making and priority-setting. These indicators should ideally facilitate monitoring at various spatial scales and provide a tool for adequate management of biodiversity at the local and national levels, as well as for regional and global overviews of biodiversity status and trends. Little progress has been made in developing indicators of biodiversity due to the low level of scientific knowledge and understanding regarding biodiversity, such as with regard to ecosystem processes and functions. A proposal for a core set of indicators on biodiversity has been prepared for consideration by the Subsidiary Body of the Convention at its fifth meeting which could lead to discussions on targets for the different work programmes (see UNEP/CBD/SBSTTA/5/12). Sustainable development indicators, developed under the Commission on Sustainable Development, currently include two indicators of biological diversity. At a recently held expert meeting, it was suggested to await the outcome of the forthcoming Subsidiary Body meeting for further elaboration of indicators of biodiversity.

14. Indicator systems have been developed and used in monitoring in North America and Sweden, for example, for boreal forests. OECD has developed indicators for energy, transport, forestry and agriculture sectors. The OECD Joint Working Party on Agriculture and the Environment is developing a set of 13 agri-environmental indicator areas. Ten of these areas — soil quality, water quality, water use, land conservation, biodiversity, wildlife habitats, landscape, farm management, farm financial resources and rural sociocultural issues — are covered in a recently published book on environmental indicators for agriculture.[2] Case studies have been provided by Mexico, Canada, New Zealand and others. The most significant progress has been made in regard to indicators for sustainable forest management (see E/CN.17/2000/6/Add.1). A number of international initiatives to define criteria for sustainable forest management and identify related indicators for measuring and monitoring progress towards increased sustainability are under way. All have specified the conservation of biodiversity as one of the 6 to 8 criteria of sustainability, and are in the process of identifying indicators for monitoring of ecosystem, species and intra-specific diversity. FAO and UNEP are developing technical guidelines to facilitate the implementation of criteria and indicators for sustainable forest management in dry zone Africa and the Near East and for monitoring.

15. Although there is still little knowledge of which and how many species are necessary for sustainable ecosystem functioning, there is increasing research in this regard. Progress made in understanding and monitoring the biodiversity-land use/management relationships is contributing to the identification of land use systems and management practices that reduce biodiversity loss and enhance its sustainable use and management in different environmental and socio-economic contexts.

Ecosystem approach

16. The increased focus, in recent years, on holistic, systemic approaches has improved knowledge and understanding of effects of changing land use and management practices on biological diversity from a focus on intra- and inter- species diversity to including diversity at the landscape level. Advances have been made, in particular in understanding the importance of sustaining ecosystem functions and life-support systems, such as the nutrient, hydrological and carbon cycles, climatic regulation, and pest and disease management processes that operate at local as well as watershed/landscape levels.

17. The Convention on Biological Diversity has adopted the ecosystem approach as the primary framework of action under the Convention, and is developing a usable definition and guidance for application. This is a strategy for integrated

management of land, water and living resources through promoting conservation and sustainable use in an equitable way. It focuses on the essential processes and functions of ecosystems, including the interactions among organisms and their environment, and on the goods and services flowing from such processes, functions and interactions.[3] It recognizes that humans and their cultural diversity are an integral component of ecosystems. The approach has been developed through a series of meetings under the Convention on Biological Diversity process, including a recent Norway/United Nations conference on the ecosystem approach for sustainable use of biological diversity (Trondheim, September 1999), which built on the earlier Malawi Principles. Based on that conference and a Convention on Biological Diversity liaison group meeting, five points of guidance for the application of the ecosystem approach have been identified, namely to:

- Focus on the functions of biodiversity in ecosystems;
- Promote the fair and equitable sharing of the benefits derived from the functions of biological diversity in ecosystems;
- Use adaptive management practices;
- Carry out management actions at the scale appropriate for the issue being addressed, with decentralization to the lowest level, as appropriate;
- Ensure intersectoral cooperation (e.g. inter-ministerial bodies and networks).

The Subsidiary Body of the Convention will discuss this issue at its fifth meeting.

18. The Ecosystem Conservation Group was revitalized in July 1998 on the initiative of UNEP, and a number of key priority areas have been identified for attention by its members (FAO, UNEP, the United Nations Educational, Scientific and Cultural Organization (UNESCO), the United Nations Development Programme (UNDP), the World Bank, the World Conservation Union (IUCN) and the World Wide Fund for Nature (WWF)) concerning the structure and functioning of the Earth's ecosystems. As a result, three issue papers have been prepared, entitled "Large-scale ecosystem management, with special reference to the marine and coastal environment", "Biodiversity and the urban environment" and "Monitoring and assessment of ecosystems".

19. Progress is being made in all regions in developing land use/resources management strategies and systems for specific types of habitats or biomes. On the basis of reviews and assessments of the status and trends of certain aspects of biological diversity and of the effectiveness of ongoing activities and instruments and identification of eventual constraints and opportunities, certain priority areas are being identified for particular attention, including geographic areas, ecosystems or resources upon which pressures are greatest and where biological diversity is more threatened or of particular value.

Landscape management strategies

20. Increased attention is being placed on the role and importance of land-use diversity within a landscape, for example for pest and disease management, pollinator and plant reproductive processes, and watershed and water resources management and the maintenance of wetland ecosystems, as well as in regard to recreation and aesthetic values. A challenge is to promote appropriate policies and institutional partnerships that can scale up and replicate across rural landscapes, ecologically based agriculture and land use to provide multiple goods and services and ecosystem functions.

21. Recognition of the serious situation in Europe's environment led to the development of the Pan European Biodiversity and Landscape Development Strategy, its joint secretariat being provided by UNEP and the Council of Europe. Problems at the landscape level were identified: the weak legal status of the area under landscape protection; disappearance and inadequate protection of many landscapes and sites, especially inland wetlands; reduced forests in many areas; increasingly fragmented and shrinking grasslands; threats to coastal and marine ecosystems, such as coastal dunes and salt marshes; and declining or threatened plant and animal species diversity. The Strategy presents an innovative, proactive and coordinated approach to halt and reverse the degradation of biological and landscape diversity values in Europe and to promote the integration of such considerations into social and economic sectors. It is a major mechanism for implementing the Convention on Biological Diversity and the Convention on the

Conservation of European Wildlife and Natural Habitat (Bern Convention),[4] and reinforces the Convention to Combat Desertification, the United Nations Framework Convention on Climate Change, the Bonn Convention on Migratory Species, the Ramsar Convention and the European Union (EU) habitats and birds directives. Considering environment protection as a complex multifaceted problem, it is based on a number of global priorities, including a balanced use of land resources; increase in forested areas; the protection of open ecosystems; the promotion of ecologically safe agriculture and stable development of regions; and the protection of all genetic, species and ecosystems diversity and all types of landscapes. It may represent a useful model for other countries and regions.

Diversified land-use systems and agro-ecological approaches

22. By adopting multiple-use strategies, many local and indigenous resource users and farmers manage, *in situ*, a continuum of agricultural and natural systems, obtaining a variety of products as well as ecological benefits. Diversified systems, such as those based on inter-cropping and agroforestry, and crop/livestock or crop/fish combinations, and those that manage the "associated biodiversity" of soil biota, pest- and disease-modulating organisms and others, may prove to be more sustainable and have been the target of considerable research. The favourable attributes are related to the higher levels of "functional" biodiversity and effects on the stabilization of agro-ecosystem processes, focusing on species composition rather than species number per se. The challenge is to manage the agro-ecosystem so as to maintain or enhance key ecological services, such as nutrient cycling, biological pest regulation and water and soil conservation. Many traditional and local systems and management practices have developed over years and generations to exploit such relationships between species and interlinkages between biological and land resources.

23. The use of livestock, for example, is essential to recycle nutrients and maintain ecosystem resilience in the traditional extensive agropastoral systems developed over generations in the drylands of Sahelian Africa, as well as in the modified intensive systems using stallfed animals in Java, Indonesia and other parts of Asia, where population pressures are high. Building on sustainable traditional systems, the Consultative Group on International Agricultural Research (CGIAR) and national research bodies have been researching ways to modify such mixed agro-ecosystems so as to improve nutrient recycling and productivity since long-term studies in Nigeria, Burkina Faso and elsewhere have shown that fertilizers alone lead to reduced organic carbon and cation exchange capacity. Similarly, agroforestry systems in which trees and shrubs are grown in association with crops or pastures for improved soil fertility management and reduced soil erosion have been well researched and documented by the International Centre for Research in Agroforestry (ICRAF) and various national research bodies.

24. Moreover, modern agro-ecological technologies that build on increased scientific knowledge of such synergies are recently proving to be more productive, especially in marginal lands and when the biological structuring of the farm is improved and labour and local resources are efficiently used. They are being adopted in diverse environments and by certain groups of farmers where the socio-economic and political environment proves propitious, as exemplified by organic agriculture, for the production of environmentally friendly but often high-value produce, especially for urban communities. The best example of spontaneous adoption on a much wider scale is that of the uptake of conservation tillage in many countries, as outlined in the reports of the Secretary-General on integrated planning and management of land resources and on sustainable agriculture and rural development.

Land husbandry and soil management including soil biota

25. The functional importance of biodiversity for the maintenance of soil fertility remains one of the most fundamental gaps in current understanding of terrestrial ecosystems, as noted in the UNEP *Global Biodiversity Assessment, 1995*, and losses of below-ground genetic and species diversity from human impacts remain largely undocumented. The conversion from forest to grassland or cropland can cause major changes in the nutrient pool and soil biota, as well as infiltration, run-off and soil erosion rates. Land management and tillage practices also affect the soil biota, fertility, structure, aeration and hydrology in various ways. The effects of heavy use of pesticides, soil fungicides and fumigants on soil biota may be dramatic as they kill

bacteria and bacteria-feeding organisms and upset the balance between pathogens and beneficial organisms, allowing disease-causing organisms to escalate. It is likely that declining soil biodiversity could weaken the resilience of the soil and its capacity to recover from disturbance after a fire, flood or excessive tillage. It could also make the soil more susceptible to disease as the natural defence systems will be disrupted.

26. A typical healthy soil may contain several species of vertebrate animals and earthworms or termites, 20 to 30 species of mites, 50 to 100 species of insects, tens of species of nematodes, hundreds of species of fungi and algae, and thousands of species of bacteria and actinomycetes. In undisturbed ecological systems, soil-water-plant relationships ensure nitrogen fixation and inorganic transformation processes; the bacterial and fungal biomass provides a stable nutrient pool. Following mechanical or chemical disturbance, these interactions may be reduced or lost and artificial fertilizers may be required to restore harvested nutrients.

27. Efforts in conventional agricultural and forestry systems have focused on soil and water management on the surface and through tillage practices to minimize soil and water erosion, and on the use of appropriate rotations and replenishment of nutrients through artificial fertilizers, manures, green mulches and crop residues in order to restore productivity. The role of the diverse soil biota in regard to the total food web has been greatly underestimated and undervalued. The functions and importance of different species and the composition of soil biota are still inadequately studied or understood. The Convention on Biological Diversity, recognizing its potential importance for the functioning and sustainability of agricultural systems, identified soil biodiversity as an area deserving special attention. A number of case studies have been conducted on soil biota and effects of land management practices and different land use systems.[5] The interactions are known to be extremely complex, not only because of the enormous population sizes and diversity in a healthy soil but also because there are both beneficial and harmful soil biota. However, as is the case for above-ground pests and predators, the harmful ones can be controlled biologically by other soil organisms.

28. Increasing attention is being paid to land husbandry or land-care approaches, which focus on the health of the land as a living entity and the holistic management of soil, water and biological resources, both above and below ground. In contrast to conventional approaches that replace harvested nutrients through fertilizers and control pests and diseases through agrochemicals, appropriate land management practices enhance the activities of soil biota and the natural processes of nutrient cycling, nitrogen fixation, soil regeneration and pest-predator relationships, as well as improving the effective use of water. The focus is not just on the resources but on making optimal use of interactions among different animals and plants, as well as the soil- plant-water relationships.

29. The first comprehensive effort in the tropics has been initiated through the DIVERSITAS[6] tropical soil biodiversity and fertility strategy programme, which is reviewing the role and importance of soil biodiversity and a balanced soil ecosystem in the sustainable management of biological diversity in agricultural and forest systems. As with the now well-publicized and widely promoted integrated pest management programme, the aim of the soil biodiversity programme is to identify ways and means of managing soil populations so as to favour beneficial interactions and minimize negative actions. Through this work as well as that by CSIRO-Australia and others, bio-indicators based on soil biota and simple tools are being developed to monitor and quantify the biological health of soils, to assess the effects of land management practices and to provide an early warning of soil degradation.

30. A healthy soil will tend to naturally break down agricultural wastes and other pollutants as long as the contamination is not severe. A soil management strategy relies on soil biota for the clean-up of organic pollutants, which can be degraded and detoxified by certain soil organisms. FAO assists countries, such as Central and East European countries, in restoring severely contaminated soils, and provides technical support to evaluate problems and help identify and promote appropriate solutions.

IV. Planning strategies and policies to address biodiversity and land resources management

Stakeholder participation and cooperation

31. A dynamic, flexible and participatory approach that takes into account changes in land use, land resources and the pressures upon them and the socio-economic environment has been shown to be essential for the management of land and biological diversity. The aim is to attain the dual goals of sustaining livelihood systems and appropriate production goals at the level of the resource user, as well as sustaining ecosystem functions at the watershed level and meeting national goals. This requires an interactive process driven by both the needs of resource users and the provision by the national and local government of an enabling environment through appropriate policies, incentives and support.

32. The role played by national and local governments has been shown to vary according to the level of decentralization, and may also vary according to the biological resources in question since some resources are allocated greater support and protection at the national level than others. Progress is being made through many capacity-building initiatives by United Nations bodies, governmental and non-governmental organizations and civil society associations, especially through funding from the Global Environment Facility (GEF). It is recognized that involving stakeholders at the local, national and regional levels, including women, the poor and indigenous people, contributes to more cost-effective and integrated implementation of the various biodiversity-related agenda and also to avoiding duplication.

National-level planning, policies and legislation

33. The extent to which land resources planning and management takes into account biodiversity depends on (a) the status of national biodiversity strategies and action plans and the degree to which these are mainstreamed with national environmental action plans and national sustainable development strategies, as well as sectoral strategies, such as national forest programmes; (b) the extent to which land-related policies, legislation and related incentive and benefit-sharing measures address biodiversity issues, such as security of tenure and access to land and other natural resources, land markets and land values; and (c) the extent to which concerned stakeholders and their biodiversity concerns are addressed and supported through institutional and legal support measures and planning processes.

34. UNEP, the World Bank and UNDP, as implementing agencies of GEF, have assisted countries in preparing biodiversity country studies, national biodiversity strategies and action plans and the first national reports to the Convention on Biological Diversity in association with other relevant organizations (WRI, IUCN, WWF etc.). GEF has supported a number of projects addressing agricultural biological diversity through land resources management, such as a regional project on the conservation and sustainable use of dryland agro-biodiversity of the Fertile Crescent, covering Lebanon, Jordan and the Syrian Arab Republic, in collaboration with several institutions.[7] The Sundarbans biodiversity conservation project in Bangladesh, co-financed by GEF, the Asian Development Bank and the Nordic Development Fund, aims to achieve the development of a sustainable management and biodiversity conservation system for the Sundarbans reserved forest resources on the basis of rational plans and participation by all stakeholders. Since 1996, the World Bank, FAO and other partners have been implementing a regional environmental information management project in Central Africa. This project aims at improving and strengthening of planning and management of natural resources in the countries of the Congo Basin by providing the various stakeholders with appropriate environmental information.

35. FAO has also been involved in project formulation for a West Africa pilot community-based natural resource wildlife management project (Burkina Faso and Côte d'Ivoire), a biodiversity conservation project (Argentina) and more recently a project on the sustainable management of the Bay of Bengal large marine ecosystem (second phase of the GEF/UNDP/FAO East Africa biodiversity project executed by FAO).

36. Increasing attention is also being paid to integrating forest biodiversity and land management. An example is the now completed UNEP Taiga model

forest project for the promotion of sustainable management and conservation of biological diversity in boreal forests of the northwest Russian Federation. A project on evaluation of impacts of forest management practices on biological diversity in Central Europe has also been launched by UNEP, Poland and the Netherlands. In addition, pilot model projects on Himalayan ecosystems[8] have led to the identification of viable options for integrated management and sustainable development of the Himalayan ecosystem, helped demonstrate to policy makers and planners the key factors contributing to sustainable land use in mountain ecosystems, and trained local communities and farmers to use and manage natural resources sustainably. FAO, IPGRI, ICRAF and several other national, bilateral, regional and international partners are joining efforts to promote integrated approaches and the development of regional strategies and action plans for the conservation, management, sustainable utilization and enhancement of forest genetic resources. Outputs of regional workshops held during the development of plans of action (held to date for Sahelian Africa, 1998; South Pacific Islands, 1999) include regional syntheses on the status of forest genetic resources and the identification of major tree species and activities amenable to regional cooperation.

37. Ongoing GEF projects on biodiversity conservation and dryland rehabilitation include the participatory rehabilitation of degraded arid and semi-arid transboundary areas of Mauritania and Senegal; management of indigenous vegetation for the rehabilitation of degraded rangelands in the arid zone of Africa; a pilot community-based natural resources and wildlife management project in West Africa; the conservation and sustainable use of dryland agrobiodiversity of the Fertile Crescent in Lebanon, Jordan and the Syrian Arab Republic, and biodiversity conservation and sustainable livelihoods options in the grasslands of East Mongolia. GEF also funds biodiversity protection projects in mountain areas in some 21 countries, as well as protected areas management and sustainable use in a number of countries. Regarding urban and peri-urban areas, the UNESCO World Network of Biosphere Reserves promotes green belts around cities (e.g., Sao Paolo and Rio de Janeiro), and the World Heritage Convention supports the conservation of valuable city environments.

Regional-level programmes and strategies

38. UNDP, with the Inter-American Development Bank, is supporting regional strategies for the conservation and sustainable management of natural resources in the Amazon through assistance in developing national strategies and legislation, biodiversity information centres and capacity-building activities. The project has contributed to the conservation of tropical forests and their biological and cultural diversity, lowering carbon emissions caused by forest burning, enhanced economic opportunities to local communities and strengthened capacity to manage resource use in indigenous lands. It has also enhanced sustainable development efforts in the region through standardizing ecological and economic zoning in eight countries and helping to formulate zoning strategies and legislation, a geographical information systems information base for four countries and a model for monitoring.

39. In recognizing the need to assist Governments and other groups in Africa in identifying and instituting policies, laws and institutions that promote convergence between agriculture and forestry in biodiversity policy formulation, a regional workshop on a biodiversity policy formulation framework in African countries was organized by UNEP, ICRAF and the African Centre for Technology Studies (Nairobi, November 1999). In addition to policies, strategies and planning processes and institutional mechanisms, concrete policy instruments are required to encourage the sustainable management of biodiversity and sustainable land use. In this regard, UNEP has provided support for regional workshops on the valuation of biodiversity for Africa (June 1999, Nairobi) and Asia and the South Pacific (Fiji, October 1999), and has commissioned various studies with a view to assisting regional-level programmes and strategies.

V. Challenges and priorities for biodiversity conservation and sustainable land use

40. Increased efforts are required to speed up the transition to more sustainable land use and environmental management through, *inter alia*,

addressing the synergies between biodiversity conservation, sustainable production and carbon sequestration, and combating desertification and drought. This requires the identification and promotion of the most appropriate and sustainable land management options that impact positively on these dimensions and that contribute to the sustainable production of goods and services to meet human needs. It also requires an enabling environment that allows stakeholder involvement, including civil society engagement through harmonized policies, local governance, security of tenure, incentive measures and strengthened capacities and opportunities, especially at the local level, to exchange, monitor and learn from experience. Guidelines, mechanisms and tools, as well as capacity-building, can assist countries in identification, assessment, priority setting and planning processes for the promotion of sustainable management systems and practices.

41. Substantial progress can be made through promoting the further development and application of landscape and ecosystem approaches for the conservation and sustainable use of biodiversity, including genetic resources for food and agriculture, and the natural resource base. These include approaches that address interactions among biological and land resources and human management activities, and that focus on ecosystem functions and services. Special attention is drawn to promoting diversification of land-use systems, the importance of maintaining a healthy and functioning soil, increasing understanding of soil biota and ensuring the effective management and use of valuable and limited water resources.

42. A challenge in the years to come will be to place a value on ecological functions and services as an incentive for their maintenance. These may include creation of markets for the carbon storage functions of different land-use types, for example as provided by the Kyoto Protocol (see E/CN.17/2000/6/Add.1), watershed functions, biodiversity conservation, pollution abatement services, and services to agriculture and forestry, such as crop pollination and biological control.

43. Greater attention is needed to enhance recognition, improve information and knowledge of biodiversity and the goods and services sustained by urban and peri-urban environments, and to develop participatory supporting strategies, plans and actions. Environmentally friendly policies, technologies and practices are needed, especially in coastal zones and small island States that are particularly subject to heavy urbanization and which also have an impact on marine habitats and species diversity through pollution and overfishing.

44. Further efforts are required to ensure the effective participation of concerned stakeholders in all levels of priority-setting and decision-making regarding biodiversity and land resources planning and management. This requires improved cross-sectoral cooperation and inter-institutional collaboration, including among government bodies, civil society groups and intergovernmental organizations. Attention is drawn to the need for the incorporation into policy-making and the implementation of flexible methodologies and practices that provide feedback through monitoring, and that allow learning by doing, in order to build on experience.

45. Efforts are needed in all countries to ensure that biodiversity issues are taken fully into account in land resources planning and management through mainstreaming national biodiversity strategies and action plans with national sustainable development, environmental and sectoral strategies. Land-related policies and legislation and related incentive and benefit-sharing measures, such as security of tenure and access to land and other natural resources, including genetic resources, should be reviewed and revised, as appropriate, to address biodiversity concerns. Institutional and legal support measures and planning processes need to be developed which support the biodiversity concerns of different stakeholders.

Notes

[1] Landscape diversity may be defined as the formal expression of the numerous relations existing in a given period between the individual or a society and a topographically defined territory, the appearance of which is the result of the action, over time, of natural and human factors and a combination of both (see Council of Europe draft recommendation on the integrated conservation of cultureal landscape areas as part of landscape policies).

[2] *OECD Conference Proceedings: Environmental Indicators for Agriculture*, vol. 2, *Issues and Design: The York Workshop* (1999).

[3] Note that the term "ecosystem" does not necessarily correspond to the terms "biome" or "ecological zone" but can refer to any functioning unit at any scale. Indeed,

the scale of analysis and action should be determined by the problem being addressed. It could, for example, be a grain of soil, a pond, a forest, a biome or the entire biosphere.

[4] The Bern Convention, adopted in September 1979, was identified in the Monaco Declaration as the main implementing instrument for the Convention on Biological Diversity in Europe.

[5] Long-term trials on the fertility and productivity effects of different management practices (tillage, land use, soil and water and soil nutrient management), including attention to soil biota, have been conducted in several OECD countries on the role of soil biota in agro-ecosystems by the Commonwealth Scientific and Industrial Research Organization (CSIRO) of Australia, in Georgia (United States of America), and by the Commonwealth Agricultural Bureau International in the United Kingdom; on functions of and agronomic affects on earthworms by Agriculture and Agri-Food Canada; and on management practices in Italy, the Netherlands and elsewhere.

[6] DIVERSITAS is a partnership of intergovernmental and non-governmental organizations formed to promote, facilitate and catalyse scientific research on biodiversity; it was established in 1991 and its secretariat is located in UNESCO.

[7] Collaborating institutions are the International Center for Agricultural Research in the Dry Areas (ICARDA), the International Plant Genetic Resources Institute (IPGRI) and the Arab Center for Studies of the Arid Zones and Dry Lands (ACSAD).

[8] Implemented by UNEP and International Centre for Integrated Mountain Development.